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Abstract

Metal-Peptide Complexes—A Novel Class of Molecular Receptors for Electrochemical Phosphate Sensing †

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Abstract: Determination of phosphate anions concentration in body fluids provides information about various disorders such as hyperparathyroidism or vitamin D deficiency. Therefore, the monitoring of phosphates level is of interest for human health. Chemical sensors are a good alternative to classic analytical methods, but their construction requires the synthesis of appropriate receptors selectively binding the analyte. Amyloid β peptides (Aβ) related to Alzheimer's Disease are well known for their neurotoxic properties. However, metal-complexes with their N-terminally truncated analogs own unique coordination properties that could be employed in the design of potential receptors for biorelevant anionic species. The $A\beta_{5\text{-}9}$ peptide possesses a His-2 binding motif and thus forms stable complexes with transition metal ions, where metal ion such as Cu(II) or Ni(II) is bound by three nitrogen (3N) from the His residue, the N-terminal amine, and the peptide backbone amide. The resulting chelates exhibit high stability and a labile coordination site enabling ternary interactions. Furthermore, metal-peptide complexes offer the possibility of fine-tuning their sensitivity and selectivity for desired applications by altering the amino acid sequence and metal ion center. The present work explores and compares the coordination and redox properties of $A\beta_{5\text{-}9}$ complexes with Cu(II) and Ni(II) ions using electrochemical and spectroscopic techniques. The ability of binding biologically relevant phosphate anions and nucleotides by metal-peptide complexes was also studied. Obtained results provided a new insight into the design of a promising class of peptide-based molecular receptors with potential application as recognition elements in electrochemical biosensors and in vitro clinical diagnostics.

Keywords: metal-peptide complexes; voltammetry; molecular receptors

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